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ABSTRACT

The purpose of this study was to investigate the more effective decision rule set between the goal oriented and the treatment oriented approach within the context of alterable and unalterable elements of instruction. Students (n=343) identified as learning disabled by their schools from grades 1 through 6 in 35 schools in a large city school district participated. Results of descriptive statistics and regression analyses revealed students with learning disabilities did make progress in reading proficiency, although there were no significant differences in effectiveness between the two decision rules in terms of student progress. A related finding was that both initial level of performance and instructional group size were important factors influencing student reading progress. That is, larger group size and low initial level performance were negatively related to the student's progress. Despite no difference in effectiveness between two decision rules, teachers who used the treatment oriented approach made more instructional changes throughout the year. Implications for student progress in reference to alterable and unalterable elements of instruction are included. (Author)

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Teachers' Data Utilization Rules Reconsidered: Relative Contributions of Alterable and Unalterable Elements of Instruction to the Progress of Students with Learning Disabilities

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Abstract

The purpose of this study was to investigate the more effective decision rule set between the goal oriented and the treatment oriented approach within the context of alterable and unalterable elements of instruction. Students identified as learning disabled by their schools from grades one through six in 35 schools in a large city school district participated. Results of descriptive statistics and regression analyses revealed students with learning disabilities did make progress in reading proficiency, although there were no significant differences in effectiveness between the two decision rules in terms of student progress. A related finding was that both initial level of performance and instructional group size were important factors influencing student reading progress. That is, larger group size and low initial level performance were negatively related to the student's progress. Despite no difference in effectiveness between two decision rules, teachers who use the treatment oriented approach made more instructional changes throughout the year. Implications for student progress in reference to alterable and unalterable elements of instruction are included.

Introduction

Educational assessment involves collecting data to specify and verify students' problems and formulate decisions about referral, screening, classification, instructional planning, and program modification (Salvia & Ysseldyke, 1985). The program modification phase involves evaluation the effectiveness of the instructional hypothesis through measurement of pupil progress, and continuing the cycle of postulating and testing instructional hypotheses. Formative evaluation is a methodology for monitoring student progress and it emphasizes this program modification phase (Fuchs, 1986). Student performance is measured over time. If data indicate that student progress toward goals is inadequate under one instruction condition, the program is modified to improve performance (White & Haring, 1980).

Curriculum-Based Measurement (CBM) is a system of measurement that teachers can use for formulating, evaluating, and modifying their instruction (Deno, 1985). Several types of CBM have proven to produce reliable and valid indicators of reading proficiency at the elementary level (Deno, Mirkin, & Chiang, 1982). Evidence has accumulated not only that using the curriculum as a basis for measurement is feasible but also that appropriate use of CBM data can help teachers create more effective instructional interventions for students with mild disabilities (Deno, 1989). The CBM procedures have also been implemented across the five decision areas: screening, identification, program planning, progress monitoring, and program evaluation to build a common metric across this continuum of decisions (Marston & Magnusson, 1987).

When used in a formative evaluation methodology, CBM can provide data for on-going program evaluation. CBM provides a rich data base for

evaluating the effectiveness of interventions. Research on the effectiveness of formative evaluations using CBM appears promising. Within the CBM framework, teachers are able to continuously monitor the effectiveness of their instruction interventions and student progress toward the Individual Education Plan (IEP) goals (Fuchs, Deno, & Mirkin, 1984). L. Fuchs and D. Fuchs (1986) found that when students' programs are monitored systematically and developed formatively over time, they gain an average .7 standard deviation units higher than students whose programs are not monitored systematically and developed formatively. This implies that continuous monitoring for developing students' instructional programs may raise the typical academic outcome score from the 50th to the 76th percentile.

The effectiveness of formative evaluation is enhanced when teachers use a systematic data utilization strategy. The purpose of existing data utilization strategies is to provide teachers with sets of decision rules which determine when changes are to be made to instructional programs (White & Haring, 1980). A data utilization rule is necessary when teachers try to evaluate and modify the intervention in a systematic way. Although teachers may collect student performance data according to designed time schedules, they frequently fail to employ those data meaningfully to develop students' educational programs (White, 1974). Tindal, Fuchs, Mirkin, Christenson, and Deno (1981) found that teachers often maintained instructional programs for long periods even when student performance data indicated that those programs were not producing student improvement. The problems of when and how to modify students' programs can be resolved by application of data utilization rules.

In a standardized formative evaluation system, two data utilization rules have been employed: goal oriented and treatment oriented rules (Marston & Magnusson, 1987). The major distinction between two rules lies in the time reference of the criterion.

In the goal oriented approach decisions about instructional changes are based upon the relation between current level of performance and the IEP goal set at a future date. This relationship is defined by the IEP aimline, that line of progress on a graph that connects baseline performance with the specified goal or criterion. All judgments about instructional effectiveness are based upon looking forward to the prescribed goal and are described by whether performance is above or below the aimline.

In figure 1, in the initial stage of Phase A, the student's performance is typically at or above the aimline, suggesting the instructional program is

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Insert Figure 1 about here

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effective. However, later in Phase A the student's performance has fallen below the aimline on three successive occasions. At this juncture, the goal oriented decision rule dictates that a change in the program is to be implemented. A change, represented by the vertical line, is illustrated in figure 1, and Phase B instruction is initiated with continuing data collection. This approach appears to be conceptually easy for teachers because it is rooted within a traditional goal oriented paradigm.

The reference of the criterion is reversed in the treatment oriented approach where decision about instructional effectiveness is based upon the

success of the past treatment. In this approach effectiveness is evaluated by drawing the trendline or slope through the previous 9 to 12 data points of CBM data. The slopes drawn by teachers on the IEP graphs are calculated with White and Haring's (1980) Quarter-Intersect method. At this point the treatment oriented approach offers two alternatives. If the rate of progress indicated from the slope line is higher than the previous period, minor modification or additions to the program may be considered.

Insert Figure 2 about here

However, if the slope indicates an undesirable rate of progress (e.g., a slope lower than in the previous phase or aimline), major changes or modification in the intervention should be considered. In the Phase A of figure 2, the flat trendline indicates that the instructional program is not successful and a change is to be made in the next phase.

The integration of findings supports the effectiveness of data utilization rules in general. A meta-analysis (L. Fuchs & D. Fuchs, 1986) showed that, on average, formative evaluation that incorporated data utilization rules was associated with increased student achievement of approximately .5 of a standard deviation unit over a monitoring without systematic rules. With rules, the mean effect magnitude was .91. However, research comparing the effectiveness of different data evaluation rules is scarce (Fuchs, 1989).

In one experimental study, Fuchs (1988) concluded that goal oriented evaluation may relate to better teacher compliance with rules and with superior student achievement outcomes. The purpose of her study was to assess the

effects of computer management of student performance data bases and different data utilization rules during a three-month training period. A significant interaction effect between computer management and data utilization rules and a data utilization main effect were found. The use of computers for data management seemed to mediate the effects of the decision rule.

Her actual findings were that, for the noncomputer group, performance was comparable within the two data utilization conditions. For the computer group, performance was superior within the goal-based evaluation condition. In her study, there were also two raw score measures (words correct score, reading; letter sequence score, spelling) used. Only the performance of the letter sequence is superior in the goal oriented approach as a result of the follow-up test. When Fuchs' results are examined closely it becomes clear that the conclusion would be valid only for the spelling measure.

In contrast, based on the superiority of the treatment oriented decision rule on achievement, Deno and Heistad (1986) found that the treatment oriented approach could be employed when using continuous curriculum-based measures. Again, this conclusion should be examined with caution. In their study, results indicated no main effect difference between Precision Teaching and Direct Instruction and no interaction between instructional strategy and decision rule. They contended that the results did indicate a main effect difference in favor of the treatment oriented group during the year 2 study. Interestingly, they used a learning rate instead of the raw scores that the Fuchs' study was based on. Yet, their conclusion was based on an unconventional statistical level of significance and on a short-term period (just phase c of the year 2).

The literature on rules for data-based decision-making is not very extensive and provides no clear evidence for choosing among available options. The future studies should be designed to address various kinds of student achievement measures over a longer time period. Whereas the timing of instructional interventions, using the decision rule, may be an important variable, it seems likely that other instructional variables may account for more of the variance of students' achievement.

In his influential article entitled "A Model of School Learning" (1963), Carroll described teaching in terms of the management of time, resources, and activities to ensure student learning. The model proposes five elements that contribute to the effectiveness of instruction: Aptitude, Ability to understand instruction, Perseverance, Opportunity, Quality of instruction. Carroll's model mixes two kinds of elements: those that are directly under the control of the teacher (alterable elements), and those that are characteristics of students, such as gender, aptitude, grade level, which are difficult to change (unalterable elements).

There have been several reviews of effects of the alterable elements of instruction on students within a process-product paradigm (Dunkin & Biddle, 1974; Brophy & Good, 1986). After reviewing ten years of research on teaching, Brophy and Good (1986) summarized and integrated the findings of process variables into several categories. The first broad category of teaching process concerns the quantity and pacing of instruction. The amount a student achieves is related to opportunities to learn. This is a study of "time on task". The second area concerns the size of the instructional group. The merits of small-group versus large-group are discussed in relation to pacing and management

demands on teachers. Progress monitoring strategies can be regarded as the important process variables like feedback. In addition to those process variables, Dunkin and Biddle (1974) emphasized the student variables such as level of ability and readiness as a presage or contextual variables.

To obtain the specific information regarding a special education instruction program, measurable goals, type amount and initiation dates of service, present level of functioning, and evaluation criteria need to be specified in the Instructional Plan (IP) (Wesson & Deno, 1989). The content of Individual Education Plan (IEP) includes little specific information regarding instruction, although it describes the student characteristics thoroughly. An IP should be examined directly to determine how special education teachers plan to deliver instruction.

Apart from the student achievement measures as product variables, in the CBM system, teachers are required to employ the data meaningfully to develop students' programs. When student performance data indicate ineffectiveness of the program, teachers should change instructional programs. As a product variable, the frequency of instructional changes is a indicator of teachers' effective utilization of decision rules.

This study will attempt to address the comparison of two decision rules in the light of student's achievement and utilization of students performance data within the context of alterable and unalterable elements of instruction. The elements of instruction can be identified in both the Individual Education Plan (IEP) and Instructional Plan (IP) (Wesson & Deno, 1989). Beyond the scope of this study are the teachers' actual practices, which can be investigated only through observation. To reiterate it, this study tries to overcome the

shortcomings of the previous studies by diversifying independent variables (alterable and unalterable elements of instruction) and dependent measures when comparing two decision rules over a longer time period, such as a year. Especially, both raw scores and learning rates were considered as student performance in CBM measures.

Method

Subject/Setting

The subjects in this study are 343 students, grades one through six (grade 1, n=16; grade 2, n=70; grade 3, n=68; grade 4, n=63; grade 5, n=68; grade 6, n=58). They are from 35 schools in a large midwestern city school district which implemented the CBM procedures fully. The distribution breakdown by gender was 62.8% male and 37.2% female. All of the students had an Individual Educational Plans (IEP) with learning disabilities and were currently receiving Level III, K-6 School Based Resource Program (up to half of student's instructional time is spent in the resource room).

In this district, as a screening process, after determining whether a referred student's performance is so different from peers, the Student Support Team (SST) makes a decision on the eligibility for further identification assessment. The identification process of students with learning disabilities is directed by the Special Education Resource Teacher (SERT). The identification assessment is composed of two types: Survey Level and Specific Level assessment. While Survey Level assessment evaluates multiple skills, Specific Level assessment tests single skills (Marston & Magnusson, 1987).

Eighty four Special Education Resource Teachers (SERT) participated in this study. In this school district, inservice training has been an ongoing

process for a staff of SERTs and tutors since the implementation of CBM. New teachers coming into the program participate in two full days of training on how to administer and score the measures. The training is designed to educate SERTs on the philosophy and research behind CBM followed by extensive experience in administration and scoring. For both administration and scoring, new SERTs must exceed .90 reliability levels before training is terminated. Magnusson, Marston, and Diment (1988) described the training procedure in detail.

Measures

Dependent measure.

Four product variables (Learning Rates, Achieving the IEP Goal, Gain Scores in grade level passages from Fall to Spring, the Number of Instructional Changes) were used.

The reading achievement of students was determined with the Curriculum-Based Measurement of reading (Deno, 1985; Marston & Magnusson, 1988). Consistent with these procedures, students were asked to read aloud for one minute periods from the district's mainstream reading series, the Holt Reading Series (Weiss, Steurer, Cruickshank, & Hunt, 1983). At the end of each reading sample, the teachers tabulated the number of words read correctly and charted the data on equal interval graph paper. For each student, the reading material corresponded to the reading level in which the IEP goal had been set in Holt. All students were presented with randomly drawn passages from the appropriate Holt level three times each week for the entire academic year. This procedure produced individual average learning rate in a progress monitoring by reading level passages (measurement level).

Individual learning rate was determined by calculating the slope of improvement using a regression method (i.e., the average increase or decrease in number of words read correctly per week) for each child. Generally, at the end of the school year, whether a student achieved the IEP goal, based on the IEP materials, was also reported.

The other reading measure was involved with a trimester review program evaluation. CBM was used for the caseload review data that SERTs collected in the Fall (the first week of October), Winter (the third week of January), Spring (the first week of May) for exit purposes and also as program evaluation data (Marston & Magnusson, 1988). Every student was measured on his/her grade level passages randomly drawn from Holt Reading Series. This procedure provided caseload reading performance data with grade level passages (grade 1, Holt level 6; grade 2, Holt level 9; grade 3, Holt level 11; grade 4, Holt level 13; grade 5, Holt level 14; grade 6, Holt level 15). The gain score was the difference of performance measured on grade level passages between Fall and Spring.

The SERTs also reported intervention changes in the individual student's graph paper so that the number of instructional changes throughout a year was obtained.

Independent variables.

Three unalterable and three alterable elements of instruction (Years Behind, Gender, Grade, Decision Rules, Instructional Period, Teacher/Student Ratio) were identified. The number of "Years Behind" is a grade level discrepancy between the grade level and the measurement level. Once the decision to assess is made, survey level assessment is the initial step of the

identification process. Often referred to as "sample back", the primary purpose of the survey level assessment is to determine the student's level of performance in that curriculum. The school district developed local norms of CBM in reading, which display the typical range of words read correctly, plus or minus one standard deviation from the district mean, at each grade level.

For example, if a sixth grade student is severely discrepant from grade level peers, having read only 12 words correctly, a teacher provides either 5th or 4th grade materials, in which his performance improved within the normal range of any grade level. If his 64 words read correctly falls into the third-grade range, which extends from 42 words correct to 136, it can be translated into his being 3 years behind in the curriculum (Marston & Magnusson, 1988). By giving survey level measures, teachers obtain the idea of years behind and the determination of IEP objectives that are measurable in the CBM system.

CBM measures have been administered and scores have been collected during the academic year. The purpose of data utilization strategies is to encourage the teachers to alter and improve instruction by providing them with a set of decision rules that determine when changes are to be made in instructional programs. In this district, special education resource teachers (SERT) chose either of two types of data utilization strategies.

In the goal oriented approach, instructional change decisions are based upon looking forward to the prescribed goal and are described by whether the last 3 median data points are above or below the aimline. Usually, SERTs collected three data points in a week and put a median data point among them in the graph. In the treatment oriented approach, the decision about the effectiveness is evaluated by drawing the trend line through the previous 9-12

data points using the quarter intersect method and examining this trend line with the aimline.

The instructional plan (IP) of an individual student provided the information about the length of the average instructional period and the average teacher/student ratio of the reading instruction in the resource room instruction every day. In this district, the SERT wrote the IP that describes the specific components of instruction. As background variables, student's gender and grade level were also reported.

Results

The objective of this study was to investigate the progress of children with learning disabilities under several elements of instruction. Preliminary analyses indicated that there was no group difference in fall caseload review data between the two decision rules ($t=1.90$, $p>.05$).

Reading Progress in Measurement Level and Grade Level Passages

Two measures of reading progress were computed. Table 1 provides the

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Insert Table 1 about here

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weekly average learning rate calculated by regression method from measurement level. The average rates ranged from .79 to 7.66 words per week (wpw) across Holt levels and .94 (grade 6) to 1.89 (grade 1) words per week across grade levels.

The average rates of the largest cell in each grade level are follows: grade 1, Holt level 6 (2.03 wpw); grade 2, Holt level 6 (1.48 wpw); grade 3, Holt level 9 (1.04 wpw); grade 4, Holt level 11 (.99 wpw); grade 5, Holt level 13 (1.00

wpw); grade 6, Holt level 13 (.95 wpw). The average rates decreased and the number of students was more evenly spreading across Holt levels as the grade levels increased.

Table 2 includes the average weekly gain of caseload review performance of grade level passages. The weekly gain is simply computed by dividing the difference between two points of testing by the number of weeks.

Insert Table 2 about here

There are three scores in trimester review data: fall, winter, and spring. The performance progress across grade levels ranged from .69 to .83 words per week (Fall to Winter), from .55 to 1.28 words per week (Winter to Spring), and from .63 to 1.06 words per week (Fall to Spring). The weekly gain also decreased as the grade levels increased. Interestingly, the weekly gains from winter to spring were higher than the gains from fall to winter except for first and second graders.

Multiple Regression and Logistic Regression Analyses

By using regression analyses, four criterion measures were explained by 6 independent variables. Table 3 provided the relationships among criterion

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Insert Table 3 about here

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measures. Among the measures, the average learning rate did not show a normality of error terms when it was used in the regression analysis. Thus the learning rate was transformed by square root to avoid the violations of normality

of error terms (Neter, Wasserman, & Kumer, 1985). As a result of transformation, normality of error terms were obtained and multiple R increased.

There were positive significant relationships among learning rate, gain score and achieving the IEP goal. The number of instruction changes was negatively correlated with other measures. In a sense, these negative relationships indicated that teachers followed the "rules of the game". Under the CBM system, teachers who complied with the data utilization rules were supposed to change interventions frequently when students' progress were low.

As a preliminary analysis, table 4 contained zero-order correlation among criterion measures and independent measures. The biggest correlation

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Insert Table 4 about here

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coefficient was .57 between Years Behind and Grade, which confirmed the nature of table 1 again. That is, as the grade level of students increased, the range of performance of students with learning disabilities also increased. The independent measures displayed negative or little relationships with the learning rate and the gain scores. The relation between the number of instructional changes and the independent measures were relatively low except for the Decision Rules. Achieving the IEP goal has a moderately negative relationship with both Years Behind and Grade (r=-.23 and r=-.13). The instructional group in a resource room of this study was relatively small-sized, ranging from 1 to 7 (mean=3.79). The average instructional time in reading is 42.5 min, ranging from 10 to 90 min.

In table 5, the results of multiple regression analysis are reported. This analysis was conducted to determine the extent to which the level of average

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Insert Table 5 about here

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learning rate could be explained by instructional variables. Although the overall F-test was significant, Years Behind was found to be the only significant independent measure ($p<.001$), which explained most of the variance of the average learning rate. Students were likely to make little progress when the initial level of performance was low.

Regression results on gain scores, reported in table 6, demonstrated the same pattern (overall $F = 10.12$, $p<.001$; Years Behind, $p<.001$). Interestingly,

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Insert Table 6 about here

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the Student/Teacher Ratio was significant ($p<.05$) in this analysis. Even in small group resource room settings, the smaller groups were more favorable. The group size was also the second most important variable in significance of the previous analysis (see table 5).

In table 7, the most important factor in increasing the frequency of instructional changes was that teachers chose the treatment oriented decision

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Insert Table 7 about here

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rule. Using the treatment oriented decision rule led to a significant increase in instructional changes ($p<.001$). Grade was also significant, which implied that teachers tended to change instruction more frequently as the grade level increased.

A logistic regression analysis provided information regarding the instructional variables to predict whether the students achieved their IEP goals. When the dependent measure is dichotomous, the least square estimation in linear regression method does not have desirable statistical properties (Hosmer & Lemeshow, 1989). In table 8, there are two chi-square values. The first test of

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Insert Table 8 about here

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goodness of fit indicated that this logistic model fitted the data. The second test of model improvement is like an overall F-test in regression. The model including 6 predictive variables told us more about the criterion variable than the model without them ($p<.05$). The Wald test (W) is comparable to a t-test in linear regression, which tests the significance of individual variables. Years Behind ($W=11.30$, $p<.001$) and Grade ($W=5.56$, $p<.05$) were found to be significant predictors. Interestingly, these two status variables had reversal relationships with achieving the IEP goal. It was unlikely for a student to achieve the IEP goal when his initial level of performance was lower than his peers. However, if all other variables were held constant, students in higher grade levels had better chances at achieving the IEP goal.

Discussion

In general, the results from this study revealed that the reading performance of children in resource rooms did increase across the school year. In each analysis, different instructional variables were differentially effective in student and teacher outcomes.

As Phillips and Clarizio (1988) contended, the increasing within grade level variability became clear as the grade level increased. For first and second graders, the most frequent Holt level (measurement level) comprised about two thirds of the sample (grade 1, Holt 6, 12 out of 16; grade 2, Holt 6, 42 out of 70). Only one third of the sample for grade levels 3 through 6 were found in the most frequent Holt levels. The variability of learning rates increased from low grade levels to high grade levels.

Average weekly gain measured by the grade-appropriate passages was relatively lower than learning rate measured by measurement level passages due to the difficulties of testing materials. In this particular sample of students with learning disabilities, the measurement level tended to be much lower than the their own grade level. The dispersion of individual weekly gains (standard deviation of weekly gains, see table 2) was also smaller than the standard deviation of learning rates in table 1. As the testing materials became more difficult, the dispersion became smaller. In other words, when the more difficult materials are used, they may limit the upper part of distribution of performance.

The average weekly gains during first semester (Fall to Winter) were lower than the average weekly gains during second semester (Winter to Spring) in grade levels 1 and 2. For grade levels 3 through 6, the reversed results showed. This might reflect the change from "learning to read" to "reading to

learn" even for students with learning disabilities. In the intermediate grades, students' curriculum would put less emphasis on the decoding skills across the school year.

Only moderate relationship was found between the learning rates by measurement level passages and reading growth (difference) from Fall to Spring by grade level passages, which showed that these two measures were not necessarily same. There was a significant negative relationship between learning rates and teachers' intervention changes. This implied that teachers changed the interventions more frequently when the learning rates were lower in the CBM system. Additionally, teachers were likely to change their interventions more frequently for students who had difficulties to achieve their IEP goals.

For both of the reading growth measures, the initial level of performance (grade level discrepancy) was the most important variable in this study. As the student was 'more years behind' than peers, he was unlikely to make good progress. The second most important variable was the instructional group size. Smaller grouping or individual instruction turned out to be more favorable. In this study, The size of the instruction group ranged from 1 to 6, which was regarded as a small grouping. Although the result did not compare a large group to a small group, smaller group arrangement was desirable in terms of academic progress even within small-grouping settings. The better academic progress of smaller grouping in special education may result from easier management and intensive instruction to increase time on task. Lower student-teacher ratio in special education is an important component of the "specialness" of special education (Thurlow, Ysseldyke & Wotruba, 1988).

Yet, review of research on the achievement effects of the individualized instruction or the smaller group instruction has uniformly concluded that this method had few if any positive effects on student achievement (Slavin, 1987). The individualization can be made effective if in addition to providing appropriate levels of instruction it also provides adequate quality of instruction. The result of this study implies that the quality of instruction and incentives of learning in the small-grouping settings of the district are appropriate on the whole.

As a teacher outcome variable in the CBM system, instructional changes were made more frequently when a teacher adopted the treatment oriented approach, partly because this decision rule might be perceived differently by teachers (Fuchs, 1988). The treatment oriented approach borrows single subject, quasi-experimental methodology and conceptualization in its sequential testing of the relative effectiveness of different instructional programs. According to Fuchs (1988), this approach appears to represent a less familiar mode of thinking than goal-based strategy that is rooted in a better known educational conceptual framework. Teachers in her study reported that the treatment oriented approach was harder to use and explain to parents and other teachers.

The treatment oriented approach seemed to be less familiar and more difficult to use and require additional opportunity for teachers to practice and rehearse the data-analytic and decision making steps. Teachers in this approach were required to draw a line of best fit using the quarter-intersect method, compared those lines to aimline, and make a decision whether progress was adequate in every 9-12 data points. To require for teachers to

review the data points in a constant period may increase the frequency of interventions.

Since there was a positive relationship between the instructional changes and grade levels in the multiple regression analysis, teachers seemed to change their instructions more frequently as the grade levels of students increased. One plausible explanation is that, in the intermediate grades, there was a large variability within grade level so that teachers tended to try various interventions.

Whether a student achieved his or her IEP goal mostly depended on the initial level of performance. Only 31% of the students achieved their IEP goals. This implies that the IEP goals for students with a lower initial level of performance were still too high to achieve.

Across all criterion measures, Gender and Instructional Period didn't make any differences. For the students with learning disabilities, gender difference of reading performance might be ignored. Additionally, more time spent teaching does not always translate into additional learning. If instructional quality, appropriateness of instruction, and incentives for learning are all high, then more time on instruction is likely to pay off in greater learning.

As reviewing alterable elements to effects on student achievement, Slavin (1987) put instructional time into two categories: allocated time and engaged time. Allocated time is the time scheduled by the teacher for a particular lesson and then actually used for instructional activities. The instructional period in the resource rooms in this study is regarded as the allocated time. In contrast, engaged time, or time on task, is largely a product of quality of instruction, student motivation, and allocated time. If active academic

time had been reported and used in this study, it might have turned out to be a effective mediating variable linking with student achievement.

Due to lack of control over variables, generalization of results, if made at all, should be made with caution. In general, a small portion of the variance of the criterion measures (around 10%) was explained by the set of predictive variables, although the overall tests of the set of predictive variables were statistically significant. To increase the predictability of criterion measures, more instructionally important variables should be considered.

Since increasing variability across grades is fundamental property of education, there was moderate-high relationship between "Grade" and "Years Behind" for even students with disabilities. As grade levels increased, the variability became larger. This may raise the multicollinearity problem when the interpretation about multiple regression results are made.

In this study, process variables of instruction such as instructional grouping and allocated time were collected in special education. Inclusion of variables in regular education settings should be arranged in order to conduct more meaningful studies, since both special education and regular education are parts of schooling.

Lastly, information gathered for this study was quantitative. Both qualitative and quantitative information describing the variables would be desirable. For example, the frequency of instructional changes didn't contain information as to the quality of each intervention. The change from one intervention to another intervention might not be implemented because of students' poor performance, rather than because of the poor quality of the intervention.

Conclusion

Although this study is limited in some respects, it does add to the current literature regarding student progress in reference to several academic variables. The students' growth in reading proficiency was clearly found within the school year across grade levels as a result of schooling. There were no differences between two decision rules in reading measures. Interestingly, teachers who used the treatment oriented decision rule tended to change instruction more frequently. Teachers may use either of the two decision rules since no differences in reading measures were found.

Yet, if the teacher is concerned about sensitivity regarding changing ineffective interventions, she may employ the treatment oriented approach. In this study, generally two or three changes in instruction were made during the academic year even when teachers used a CBM. Making data-based changes is the component of the CBM system that should produce increased achievement (Wesson & Deno, 1989). In other words, with a good repertoire of teaching activities, changing instruction in response to student needs is a necessary condition to achievement. The frequent changes may lead to the better performance over a longer time period.

The status variables, such as the initial level of performance or "Years Behind" seem to have significant relationships with students' progress in this study. Does it mean that teaching students with learning disabilities is doomed to failure? The answer is, of course, no. Initial level of performance appears to account for very small portion of the variance in student progress. What this significance relationship does support is the age-old maxim that teaching students with learning disabilities should take into consideration the

developmental status of students and the individualized (or small group) instruction.

The results of this study reexamined that, in special education, the initial level of performance and small grouping are important factors influencing students' academic progress. As a matter of fact, these two factors make the "specialness" of resource room instruction for students with learning disabilities.

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Table 1

Mean Weekly Increase in Words Read Correctly from Measurement Level Holt Passages for Students at Different Grade Levels

Holt Level	Grade 1 Mean (n) SD	2 Mean (n) SD	3 Mean (n) SD	4 Mean (n) SD	5 Mean (n) SD	6 Mean (n) SD	Subtotal Mean (n) SD
2-5	1.24 (3) .09	1.51 (1) 0.0			7.66 (1) 0.0		2.58 (5) 2.54
6	2.03 (12) 1.23	1.48 (42) 1.33	1.12 (5) .82	.50 (2) .47			1.52 (61) 1.28
7	2.16 (1) 0.0	1.38 (5) 1.33	2.09 (4) 1.35	1.98 (1) 0.0			1.76 (11) 1.18
8		2.24 (5) 1.82	1.21 (9) .45	1.14 (3) .25	.34 (1) 0.0	1.20 (1) 0.0	1.42 (19) 1.06
9		.71 (13) .86	1.04 (24) .59	.94 (14) .62	2.19 (4) 2.12	.36 (2) .11	1.00 (57) .88
10		.94 (10) 0.0	.81 (3) .41	.99 (7) .36	1.46 (3) .21		1.05 (14) .38
11		1.47 (3) .25	.61 (21) 1.60	.99 (26) .76	.81 (14) .41	1.05 (8) .50	.87 (72) 1.02
12				.48 (5) .83	1.02 (6) .40	.84 (3) .65	.79 (14) .64
13				.99 (5) 1.14	1.00 (23) .96	.95 (19) .61	.98 (29) .84
14			.83 (1) 0.0		.87 (14) .39	1.12 (14) .82	.99 (29) .63
15					1.11 (2) .64	.75 (11) .31	.80 (13) .37
19			.96 (1) 0.0				.96 (1) 0.0
Subtotal	1.89 (16)	1.38 (70)	.98 (68)	.95 (63)	1.12 (68)	.94 (58)	
(Grade)	1.10	1.28	1.08	.71	1.16	.60	

Table 2

Average Weekly Gain (No. of Words Read Correctly) of Caseload Performance

	Grade					
	1	2	3	4	5	6
(n)	(16)	(70)	(68)	(63)	(68)	(58)
Period						
Fall to Winter						
Mean	.83	.71	.76	.69	.78	.72
(SD)	(.54)	(.86)	(.57)	(.55)	(.65)	(.50)
Winter to Spring						
Mean	1.28	.94	.60	.57	.75	.55
(SD)	(1.16)	(.73)	(.63)	(.58)	(.63)	(.54)
Fall to Spring						
Mean	1.06	.82	.68	.63	.77	.64
(SD)	(.70)	(.65)	(.42)	(.34)	(.34)	(.35)

Table 3

Intercorrelations Between Criterion Measures

Variable	1	2	3	4
1. Learning Rate [a]	1.00	.35**	-.20**	.33**
2. Gain from Fall to Spring		1.00	-.11	.23**
3. Instructional Changes			1.00	-.24**
4. Achieving the IEP Goal [b]				1.00
Mean	1.03	23.27	2.30	.38
SD	.37	14.92	1.39	.49
Maximum	7.65	144.00	7	1
Minimum	-6.00	-20.00	1	0

a Transformed variable (squre root of Average Learning Rate)
b Dummy variable coded 1=Yes, 0=No for achieving the IEP goal.
** $p<.01$.

Table 4

Zero-order Correlation Coefficient

Variable	5	6	7	8	9	10
1 Learning Rate [a]	-.30	-.22	-.06	-.02	.01	.01
2 Gain Scores(Fall to Spring)	-.36	-.14	-.09	-.10	-.04	-.05
3 Instructional Changes	.00	-.01	.08	-.09	.16	.05
4 Achieving the IEP Goal [b]	-.23	-.13	-.10	.11	-.08	.03
5 Years Behind	1.00					
6 Grade	.57	1.00				
7 Student/Teacher Ratio	-.04	-.06	1.00			
8 Instructional Period (min)	.01	-.15	.01	1.00		
9 Decision Rules [c]	-.08	-.04	-.06	.07	1.00	
10 Gender	-.09	-.02	.04	.03	.01	1.00
Mean	1.77	3.79	3.42	42.54	1.18	.63
SD	.96	1.51	1.44	13.74	.38	.48
Maximum	5	6	6	90	2	1
Minimum	0	1	1	10	1	0

a Transformed variable (squre root of Average Learning Rate)
b Dummy variable coded 1=Yes, 0=No for achieving the IEP goal.
c Dummy variable coded 1=Goal oriented rule, 2=Treatment oriented rule.
d Dummy variable coded 1=Male, 2=Female

Table 5

Multiple Regression Results: Average Leaning Rate [a]

	Unstandardized Coefficient	Standardized Coefficient	t
Years Behind	-.097 (.028)	-.253	-3.476***
Student/Teacher Ratio	-.020 (.015)	-.078	-1.323
Grade	-.020 (.018)	-.085	-1.158
Instructional Period (min)	-.001 (.002)	-.031	- .516
Decision Rules	-.017 (0.57)	-.017	- .294
Gender	-.003 (.045)	-.004	- .071
R^2	.099		
Adjusted R^2	.082		
Overall F-test	5.67 ***		

Note. Standard errors are in parentheses.
a Transformed variable (squre root of Average Learning Rate)
*** p<.001.

Table 6

Multiple Regression Results: Gain Scores from Fall to Spring

	Unstandardized Coefficient	Standardized Coefficient	t
Years Behind	-6.728 (1.025)	-.429	-6.567***
Student/Teacher Ratio	-1.285 (0.582)	-.132	-2.421*
Instructional Period (min)	-0.075 (0.059)	-.069	-1.278
Decision Rules	-2.316 (2.115)	-.069	-1.095
Gender	-1.713 (1.635)	-.065	-1.048
Grade	.577 (0.582)	.065	.991
R^2	.171		
Adjusted R^2	.154		
Overall F-test	10.12 ***		

Note. Standard errors are in parentheses.
* p<.05. *** p<.001.

Table 7

Multiple Regression Results: Instructional Changes

	Unstandardized Coefficient	Standardized Coefficient	t
Decision Rules	.552 (.172)	.161	3.206 ***
Grade	.136 (.047)	.177	2.858 **
Student/Teacher Ratio	.073 (.043)	.087	1.693
Instructional Period (min)	-.006 (.005)	-.063	-1.253
Gender	.078 (.133)	.029	.583
Years Behind	-.045 (.083)	-.034	-.545
R^2	.058		
Adjusted R^2	.043		
Overall F-test	3.84 **		

Note. Standard errors are in parentheses.
** p<.01. *** p<.001.

Table 8

Logistic Regression Results: Achieving the IEP goal

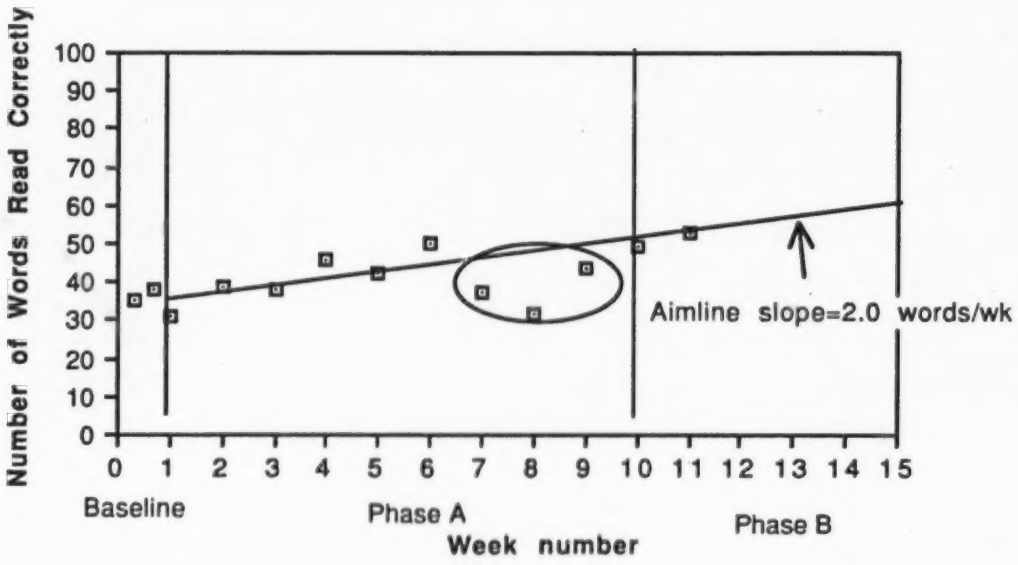
	Unstandardized Coefficient	W	
Years Behind	-.593 (.176)	11.299	***
Grade	.237 (.100)	5.562	*
Instructional Period (min)	.010 (.009)	1.223	
Gender	.131 (.260)	.255	
Decision Rules	.154 (.323)	.228	
Student/Teacher Ratio	-.034 (.088)	.148	
Goodness of fit	Chi-square	315.55	(df=308)
Model Improvement	Chi-square	13.79 *	(df=6)

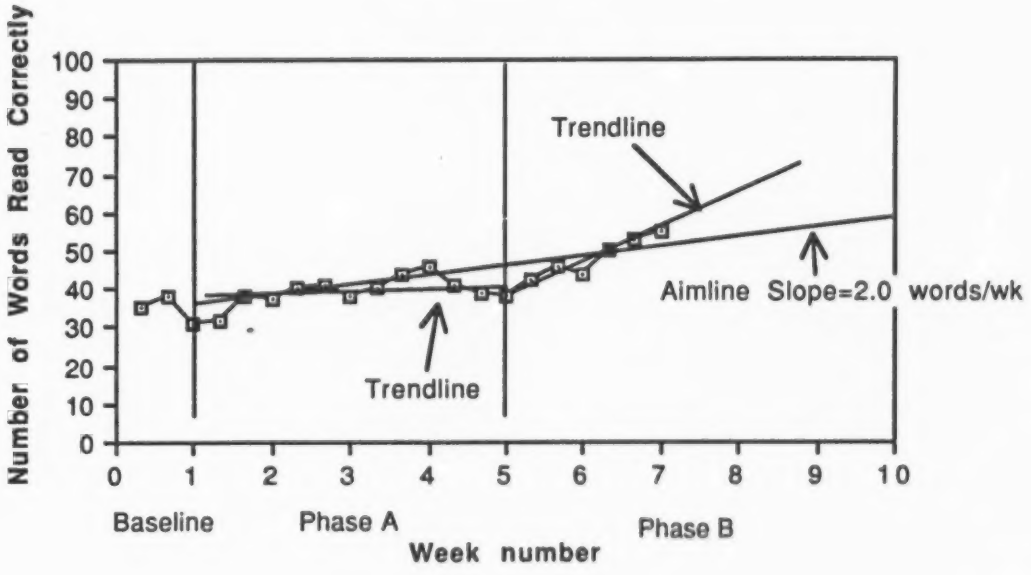
Note. Standard errors are in parentheses.
* p<.05. *** p<.001.

Figure Captions

Figure 1. Goal oriented approach.

Figure 2. Treatment oriented approach.


Number of Words Read Correctly
100
90
80
70
60
50
40
30
20
10
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Baseline
Phase A
Phase B
Week number
Aimline slope=2.0 words/wk


Number of Words Read Correctly
100
90
80
70
60
50
40
30
20
10
0
Trendline
Aimline Slope=2.0 words/wk
Trendline
0
1
2
3
4
5
6
7
8
9
10
Baseline
Phase A
Phase B
Week number